



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

fourth place of decimals quite uncertain. The remarkable extension of the spectrum of this electric light, both at the red and violet ends, is, however, indisputable.

Electric light.	Sunlight.
Limit of red 1·6025 (about)	Line X 1·6038
— — — — —	„ A 1·6069
— — — — —	„ G 1·6404
Bundle of violet rays ... 1·6436	— — — — —
Faint violet ray 1·6516	„ K 1·6513
2nd „ „ 1·6531 (about)	— — — — —
Bright violet ray 1·6550	„ I 1·6548
Faint ray 1·6562 (about)	— — — — —
„ „ 1·6574 (about)	„ L 1·6567
Limit of violet 1·6664 (about)	„ N (1st) 1·6642

VI. “On Great Fluctuations of Temperature in the Arctic Winter.” By J. J. MURPHY, Esq. Communicated by Professor W. THOMSON. Received June 7, 1861.

It might be expected that the climate of the Arctic Regions during winter, in the absence of the sun, must be almost a dead level of intense cold; but so far is this from being the case, that there is no other place and time where such great and rapid fluctuations of temperature have been observed.

This phenomenon is thus mentioned in the appendix to Wrangell's account of his expedition to the Siberian coasts of the Polar Sea :—

“ Sometimes in the middle of winter a wind from the S.E. by E. causes the temperature to rise suddenly from -24° to $+25^{\circ}$, or even $+32^{\circ}$: previously to this, the barometer sinks as much as four-tenths of an inch in the course of eight hours. The S.S.E. wind has no particular influence either on the barometer or thermometer.”

In “The Search for Sir John Franklin,” published in No. 1 of the ‘Cornhill Magazine,’ occurs the following notice of the same phenomenon. The ‘Fox’ was beset by vast fields of ice somewhere in Baffin's Bay :—

“ December 28. During Divine Service yesterday the wind increased, and towards the afternoon we had a gale from the north-westward, attended with an unusual rise of temperature: today the gale continues, with a warm wind from the N.N.W.

“The Danish settlers at Upernavik, in North Greenland, are at times startled by a similar sudden rise of temperature. During the

depth of winter, when all nature has long been frozen, and the sound of falling water has long been forgotten, rain will fall in torrents; and as rain in such a climate is attended with every discomfort, this is looked upon as a most unwelcome phenomenon. It is called the *warm south-east wind*. Now, if the Greenlanders at Upernavik are astonished at a warm south-east wind, how much rather must the seamen, frozen up in the pack, be astonished at a warm north-west wind! Various theories have been started to account for this phenomenon; but it appears most probable that a rotatory gale passes over the place, and that the rise of temperature is due to the direction from which the whole mass of air may come, viz. from the southward, and not to the direction of the wind at the time*.”

The cause here assigned appears to me quite insufficient: the rise of the thermometer that we have to account for sometimes amounts to 70° or 80°, which is equal to the difference between very warm summer weather and very hard frost in our climate; and it is unexampled, and I think inconceivable, that any motion of a mass of air from warmer latitudes should produce so great an effect on the temperature; certainly the cyclones that come from the West Indian Seas and pass over our islands have no effect in the slightest degree approaching to it.

What I regard as the true cause of the phenomenon is suggested, though not distinctly pointed out, in Dr. Kane's Narrative, from which I will make a few extracts:—

“January 29. A dark water sky extended in a wedge from Littleton to a point north of the Cape. Everywhere else the firmament was obscured by mist. The height of the barometer continued as we left it at the brig, and our own sensations of warmth convinced us that we were about to have a snow-storm. * * * We were barely housed before the storm broke upon us. Here, completely excluded from the knowledge of things without, we passed many miserable hours. We could keep no note of time, and, except by the whirring of the drift against the roof of our kennel, had no information of the state of the weather. * * * We then turned in to sleep again, no longer heedful of the storm, for it had buried us deep in with the snow. But in the meantime, although the storm continued, the temperatures underwent an extraordinary change. I was awakened by the dropping of

* The writer in the ‘Cornhill Magazine’ prints this second paragraph in inverted commas, but does not state whence he has quoted it.

water from the roof above me ; and upon turning back my sleeping bag, found it saturated by the melting of its previously condensed hoar-frost. My eider-down was like a wet swab. I afterwards found that the phenomenon of the warm south-east had come unexpectedly upon us. The thermometers at the brig indicated $+26^{\circ}$, and, closer as we were to the water, the weather was probably above the freezing-point. When we left the brig—how long before it was we did not know—the temperature was -44° . It had risen at least seventy degrees. * * * In the morning—that is to say, when the combined light of the noon-day dawn and the circumpolar moon permitted our escape—I found, by comparing the time as indicated by the Great Bear with the increased altitude of the moon, that we had been pent up nearly two days.”

It appears from these extracts, that although Dr. Kane did not see open water, he was made aware of its neighbourhood by the infallible sign of a “Water Sky.” A rise of temperature to a few degrees above frost would be quite insufficient to produce open water by melting through the fields of ice in forty-eight hours ; but, on the other hand, the breaking up of the fields of ice by a storm is an adequate cause for a great rise of temperature ; for the water immediately below the ice is at the temperature of sea-water at its freezing-point, which is $+28^{\circ}$; so that when a storm comes and breaks up the ice, the water comes into contact with air 70° or 80° colder, and warms the air.

There is no doubt of the power of a storm to break up the ice. Sir James Ross speaks of “the almost magical power of the sea in breaking up land-ice or extensive floes of from twenty to thirty feet thick, which have, in a few minutes after the swell reached them, been broken up into small fragments by the power of the waves.” The theory that these sudden rises of temperature are caused by storms breaking up the ice and exposing the comparatively warm water below, also harmonizes with the fact that the warm winds, as mentioned by the officer of the ‘Fox,’ in different parts of Baffin’s Bay come from different points of the compass ; while on the same coast they come from the same point. Thus Wrangell, as quoted above, mentions that in the part of the Siberian coast which he explored, a S.E. by E. wind sometimes raises the thermometer upwards of fifty degrees, while a S.S.E. wind has no effect on the temperature at all. This proves that the rise of temperature cannot be due to the transport of a mass

of warm air; but it may be easily accounted for by supposing that the form of the coast enables the warmth-producing wind to act at a special advantage in breaking up or driving away the ice, and liberating the heat of the waters.

These extraordinary fluctuations of temperature appear to be common to the whole of the Arctic regions. Sir John Richardson, in his recent work on the Polar regions, states that "in Arctic America the phenomenon of warm winds (*teplot weter* of Wrangell) also occurs, and makes the month in which they happen, whether December, January, or February, warmer than the other two. The same warm wind was probably the cause of the rain which the Russian sailors observed in Spitzbergen in the month of January."

Rain implies a temperature several degrees above $+28^{\circ}$, which is the temperature of the stratum of sea-water immediately below the ice. But we know that in the Polar regions the temperature of the sea increases in descending, until a stratum is reached of the invariable temperature of $+39^{\circ}$; and we may suppose that in these storms the warmer water of the deeper strata is brought to the surface, and warms the air sufficiently to admit of rain. We know that powerful winds are able to produce temporary local currents, and it is easy to see that such a current, when produced in a limited space free of ice, will give rise to this kind of *vertical circulation*, or interchange between strata of different depths.

Such storms as these must be eminently favourable to the production of rain; for the air that becomes warmed by contact with the comparatively warm water will, of course, take up watery vapour, and when it comes into contact with other masses of air that retain their usual intense cold, the vapour will be rapidly condensed; so that we cannot wonder at heavy rains being a general concomitant of these storms.

Wrangell, in the passages I have quoted, says the warm wind in Siberia is preceded by a fall of the barometer. Dr. Kane, on the contrary, noticed a rise before the storm above described; it stood at "the extraordinary height of 30.85." I cannot suggest any explanation of these facts.

I believe I have now stated the true cause of what is certainly a very remarkable phenomenon—fluctuations of temperature of enormous magnitude, occurring in a very short time, and in the absence of the sun.